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Field-dependent antiferro-ferromagnetic transition in Co/Ru superlattices (abstract)

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Co/Ru hcp (0001) superlattices were grown by UHV evaporation onto mica substrates. We demonstrate the growth of epitaxially ordered Co/Ru superlattices–despite the large lattice mismatch ($\sim$ 8%)–consisting of hcp (0001) Co and Ru sublayers initialized on 150-Å-thick single-crystalline Ru buffer layer by using RHEED and x-ray diffraction. The magnetic properties were studied by magnetization and ferromagnetic resonance (FMR) measurements. For uncoupled Co layers, the resultant anisotropy switch from planar to axial direction (perpendicular to the film plane) with decreasing Co sublayers thickness. For Co sublayer thickness smaller than a critical one $t_{co} \sim 14$ Å, the magnetization is directed perpendicular to the film plane. For small Ru interlayer thickness, large antiferromagnetic exchange coupling between the Co sublayers is observed in agreement with precious results. For a certain range of Co and Ru thicknesses, superlattices with unique magnetic parameters are obtained. Indeed, in the absence of an applied field, the magnetization is oriented along the film normal while the adjacent Co layers are coupled antiferromagnetically. For this magnetic structure, the magnetization process exhibits a hysteresis and the FMR spectra an irreversible behavior when the applied field is along the film normal. As shown by SQUID measurements, when the field is decreased from a quasi-saturated state, the layers are

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essentially coupled ferromagnetically, the antiferromagnetic state appearing following a spin-flip process (staircaselike on the magnetization curve) for a field smaller than a critical one. However, with increasing field, the antiferromagnetic state disappears by progressive steps suggesting that the spin reorientation process occurs by coherent rotation of the magnetization combined with spin-flip process. The occurrence of this effect is particularly spectacular on the FMR spectra. With decreasing field, a classical FMR absorption is observed due to the basical ferromagnetic state while with increasing field, this absorption is largely reduced or disappears completely due to the antiferromagnetic one. The magnitude of the hysteresis and its evolution with the direction of the applied field, the values of the critical field corresponding to the spin flip and to the field above which the magnetic state is reversible, are very well correlated on the FMR spectra and the magnetization curves. Journal of Applied Physics is copyrighted by The American Institute of Physics.

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(long-range chem. order and induced **lattice** deformation along growth direction in epitaxial)

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AN 85:134846 CA
TI Study of a change in the **lattice** constant of a ruthenium-based ternary solid solution by mathematical planning of an experiment
AU Akopyan, A. S.; Tatarkina, A. L.; Raevskaya, M. V.; Sokolova, I. G.; Sokolovskaya, E. M.
CS Moscow, USSR
SO Izv. Akad. Nauk SSSR, Met. (1976) (3), 210-14
CODEN: IZNMAQ
DT Journal
LA Russian
CC 75-5 (Crystallization and Crystal Structure)
AB To describe the variations in the lattice parameter a of

Ru-based Ru-Ni-Fe, Ru-Ni-Co, and Ru-Co-Fe solid solns., the method of simplex-**lattice** design was applied. After preliminary transformation of the simplex subregions and introduction of new coordinates, the system of matrix equations thus-obtained was treated to find polynomial solns. for a. The model correctness was verified by comparing the theor. a values with the exptl. ones obtained for several preselected points from the triangular compn. diagrams. According to the t-criterion, the model adequacy is satisfactory. The derived equations were used to plot the isoparametric lines for the examd. ternary systems. The following conclusions could be drawn: (1) the compn.-induced variations in a obey the regularities obsd. for ternary systems, (2) a decreases with diminishing Ru content, and (3) ternary alloys with various concns. of Group VIII elements may have the same a.
ST structure detn ruthenium ternary alloy
IT 60527-73-3 **60527-74-4 60527-75-5**
RL: PRP (Properties)
(crystal structure of)

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